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REVIEW OF PROJECT SAFE

Report to

Consolidated SAFE Project Office

July 1984

Reference 50738

Arthur D. Little, Inc.

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INTRODUCTION

During March-June 1984, Arthur D. Little, Inc. performed a review of Project SAFE. Its purpose was to provide the Consolidated SAFE Project Office with recommendations about the overall management and future course of the Project. Oral presentations of the results were made separately to CSPO, CIA, DIA, and the IC staff; this report is a brief summary of the presentations.

The report is in two sections:

- Observations and Implications, in which we record our observations and relate them to our experience with comparable technology in industry; and

- Overall Recommendations which result from consideration of the implications taken together.

Our review was not conducted in great depth. We talked with user representatives and read surveys of user reactions, but did not talk to significant numbers of individual users. We talked with the managers of contractor activities, but did not talk with individual contractor employees or study their work product. It is therefore possible that our results contain inaccuracies of detail. We doubt, however, that we have missed any major factor that might affect the overall course of Project SAFE.

In December 1982, Arthur D. Little, Inc. submitted the written report of a more comprehensive review of Project SAFE. References to it are made in this report, but this report is complete in itself.

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1. OBSERVATIONS AND IMPLICATIONS

1.1 User Reactions

Users in both CIA and DIA are generally satisfied with the functionality provided by Delivery 1 of SAFE. They have had some difficulty mastering all of the capabilities, particularly in designing interest profiles that provide adequate discrimination while at the same time covering a broad enough scope, but this is inevitable with such a versatile system and will pass.

The users have a variety of desires for new services. Some of them are ideas for enhancements of the present mail and text function group; others range across a variety of processing tools that might be made available either in subsequent modifications of SAFE in the library of CMS-based tools that the more sophisticated analysts are already accustomed to using. Generally, however, user desires for new services relate more to communications scope and interfaces with other systems than to enhanced or novel functions. The analysts were anxious to talk to one another in their own branches, in other branches, and in other agencies where comparable work is performed; to data bases both inside and outside the intelligence community; and via SAFE to other systems and communications nets throughout the community.

We also noted that in DIA the users tend to be frustrated with the installation approach that has been followed (putting relatively small numbers of terminals in a large number of branches). Frustration arises from the inability to share communications with one's fellow analysts working on the same problem, to obtain help with the operation of the system.

As a result of these observations, we repeat the recommendation from our earlier report that greater emphasis be placed on increasing the rate of terminal installation than on the addition of new features. It is true, of course, that Deliveries 2, 3, and 4 of SAFE cannot be delayed beyond their present dates, though Delivery 5 might be. In any case, we hope that funds can be found to accelerate the rate of installation and training, especially in DIA. To facilitate the latter, it might be possible to streamline the training course into a series of short increments, to provide on-line assistance to users, and to rely in part on a "buddy system" in which already-trained analysts are asked to help others working near them who are only partially trained.

1.2 SUL Vs. AIM

Shortly before our study was undertaken, the decision was made to substitute the AIM software and interface language for the previously-adopted SAFE User Language. Our review of this decision indicated the following.

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First, during the course of the deliberations on this issue, the specifications of the AIM interface language changed in many important ways: in the end they became very similar to those originally specified for the SUL. In our judgment, the remaining omissions from the SUL are unimportant and are offset by the fact that their omission simplifies the interface with the user. For instance, the interface that was adopted includes the simultaneous display of two windows to the user, while the original SUL calls for four. We believe from experience with personal computers in industry that it is not practical to attempt to keep track simultaneously of more than two windows at a time.

Second, we observed that the processing architecture developed for AIM has been extensively redesigned to improve flexibility, modularity, and to improve throughput. As a result of these changes, it is possible to be more confident than before that Deliveries 2 and 3 of SAFE can be implemented without major technical difficulty because: Deliveries 2 and 3 are now a major evolutionary step from existing software rather than an entirely new creation.

These observations lead us to conclude that the correct result has been obtained: that AIM with extensive reworks and modifications represents a better and more reliable approach to meeting the objectives of Project SAFE than the original top-down comprehensive design.

Although Deliveries 2 and 3 are evolutionary rather than revolutionary products, they are nevertheless a very major step forward, and will constitute the first real challenge to the software integration, validation and verification, documentation, and installation capabilities of CSPO. These appear adequate to us to meet the tasks that lie ahead, but have not yet been proved by installations of the magnitude of Deliveries 2 and 3.

System responsiveness may also pose difficulties. In Deliveries 2 and 3, the number of users and the capabilities available to them will both be much greater. It may be that the user responsiveness at peak periods will deteriorate to an unacceptable degree. A similar problem was observed before with Early Capability SAFE. The DAP solved the problem then, but no comparable improvement is contemplated for Deliveries 2 and 3 after their initial delivery. Predictive performance modeling is possible, and we reiterate the recommendation of our earlier report that CSPO undertake such modeling.

With the additions to AIM, Deliveries 2 and 3 have become very comprehensive. They include all of the file, text and mail-handling functions which are common to all analysts in DIA and CIA. Most of the major additions to SAFE beyond Deliveries 2 and 3 are specific to one Agency or the other. Those changes that will be occurring to the common SAFE will be more of an evolutionary or additive nature to the

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existing Deliveries 2 and 3 than major new products of the magnitude of Deliveries 2 and 3. We suggest that they be considered the first release of the complete basic or core SAFE.

1.3 Contractor Roles

In the past there has been some difficulty in meshing the contractors so that they work together at full efficiency. Examples existed of over-management, of attention to details that turned out to be irrelevant or superseded, and of a certain amount of unnecessary communicating and reiteration of presentations. This situation has apparently improved markedly, and we think it will not recur.

The underlying reason for the difficulties of the past was uncertainty about the course of the Project. As long as the choice of user language was undecided the contractors were unable to proceed in the straight line manner envisioned in the Project plan. In attempting to do so, they did unnecessary and redundant work. Now that it has been decided that the user interface will be the augmented AIM, all parties have been able to swing into line behind it and make steady progress. In the meantime, it appears that the contractor personnel have learned more about the Project, and that there have been sufficient changes and additions to their staffs. We see no reason to make significant further changes in the roles, reporting relationships, or distribution of responsibilities among the contractors.

Typically, when an information system is complete, accepted, and put into routine use, the Project team that developed it dissolves, and a maintenance contract is let that (with renewals) lasts for the life of the system. We therefore reviewed the possibility that a contractor might at some future time take over the further maintenance of the SAFE system. We think this will probably not be possible. Even though major deliveries of new capabilities of SAFE may stop, major evolutionary change will not. New capabilities will continually be added to the core of SAFE (first delivered as Deliveries 2 and 3), and new interfaces to community systems and networks are likely to continue evolving for at least ten years into the future. What is needed is a long-term source of support, smaller than that devoted to the building of a new system, but larger than that devoted to the operation and maintenance of a mature system that changes very little. We think that such a source of support can only be found within the community itself, though much of the implementation required can be contracted outside. This subject is discussed further in Section 2.

1.4 Release Schedules

In the past, delays in SAFE have been caused primarily by difficulties in reaching final agreements on specifications. There has been little trouble with on-time delivery of pieces of the system once those pieces have been finally defined. The specifications for Deliveries 2

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and 3 are now clear and bounded (in the sense that any changes occurring from now on will only be minor trade-offs in details within the bounds of what has been agreed upon). It should therefore be possible to go forward in an efficient manner to completion of Deliveries 2 and 3. The DIA-critical requirements for Delivery 4 are now also clear and bounded. The integrated data base, DoDIIS interface and the like have been fully defined, but some loose ends remain in the specifications for Delivery 4. These mostly relate to possible enhancements to the core functions of SAFE which are defined as part of Delivery 5. In order that Delivery 4 have the maximum chance of being delivered on schedule, we believe that enhancements to the core of SAFE should be delayed if there is any possibility of their interfering with the critical delivery date for Delivery 4. The SAFE core should be frozen at the level of Delivery 3 until Delivery 4 has been satisfactorily completed, unless it is certain that enhancements can be incorporated on the basis of finished and proved work that cannot possibly cause a delay.

Delivery 5 appears to us to consist of two independent parts that can be separately scheduled. One part consists of enhancements to the core of SAFE, as noted above, mainly in the areas of improved indexes to text files. A second part consists of the implementation of CIA-specific interfaces and conversions, such as the transfer of the central index files to SAFE, the transfer of AIM users to SAFE, and the addition of wire service and NOMAD interfaces. The CIA-specific developments can occur at any time CIA wishes them to without relationship to the installation of Delivery 4 or to the enhancements that may prove to be desired to the core of SAFE. We therefore suggest that Delivery 5 be redefined as two independently scheduled parts: a new release consisting of enhancements to the core of SAFE, and a set of conversions and interfaces to be implemented within CIA at CIA's convenience.

1.5 Schedule Realism

As noted above, the pacing factor in SAFE's scheduling has apparently always been the ability to converge upon final and bounded specifications. Convergence has occurred for Deliveries 2 and 3, and if the changes recommended above are implemented, will also have occurred for Delivery 4.

Our discussions with the contractors indicated that each of them appears to be satisfactorily conversant with the task assigned to him, adequately manned, adequately managed by CSPO, and therefore likely to be on schedule. (As noted in the Introduction, we did not audit the actual work in progress, so we cannot verify the state of each contractor's work on the basis of personal observation. However, our cumulative experience leads us to place confidence in the contractors' representations. We also observed that the overall scheduling of the deliveries appears to be conservative, particularly in the time

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allowed for system tests. We cannot be sure that system testing can actually be completed in less time than has been allowed, but it seems possible.

Finally, we note that should Delivery 4 slip for reasons we cannot foresee, there will be an alternative available to DIA. Apparently an IBM-based system incorporating MVS software and the DoDIIS modifications to the model 204 data base management system will be separately implemented within DoD, and it will be possible for DIA to develop a contingency plan to adopt this system for its IDB, if Delivery 4 of SAFE should slip. Therefore, considering the probability that Delivery 4 will be on schedule and the possibility of having an alternative system available, we can forecast with some confidence that the planned 1986 shut-down of the DIALOS system appears feasible.

1.6 Degree of Software Uniqueness

The objective of Project SAFE is to be as industry standard as possible: to use industry standard hardware and systems programs and to develop only that software which must be unique to the intelligence community. In our report of December 1982, we recommended a steady effort to reduce this degree of software uniqueness.

We observe that the present plans for Project SAFE involve about the same amount of unique software as we saw in 1982. The operating systems are essentially the same, incorporating the same amount of CIA-developed modification as was planned then. The enhanced AIM is just as unique as the SUL implementation software would have been. Among the modified industry packages, the INQUIRE text data base manager is probably going to be implemented in a more standard manner than was envisioned earlier, but the model 204 data base manager will have some additional unique software which was not anticipated then.

Perhaps more important, we are less optimistic than we were in 1982 that the SAFE software will be overtaken by commercial products in the near term. We forecast in 1982 that within five years all of the functionality of SAFE could be obtained via commercial products. We still think this will eventually be the case, but it will take more than five years. The evolution of imaginative packages for personal computers is continuing rapidly, but the necessary host-based network control capabilities are not. There is no software system in industry that matches the mail routing, full text searching, and individual profiling capabilities that have already been implemented in Delivery 1 of SAFE, and there will not be for several years. Industrial users of office automation software are slowly involving increasing requirements for electronic mail, but are unlikely to reach those of the intelligence community for some time. Commercial software will not be able to replace Project SAFE software in its entirety, until both the interface software for the personal computer and the network control software comparable to SAFE's mail management functions are combined.

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We think this combined set of capabilities will not be available from industry until about 1990.

When the full capability of SAFE is available commercially, it will probably be implemented in a different manner. By then intelligent user terminals will probably all be personal computers with great compute power and memory size: the user windows, user-specific files, and maintenance of user states will probably be managed primarily within the user-dedicated personal computers, rather than in the central systems, as in SAFE. The central systems will be reduced to providing resources: the switching and screening functions for mail passing through the center, and the control of centralized multi-user file resources. To put it simply, activities specific to the individual user will be located at the user site, and resources that support multiple users will remain centralized. Sometime around 1990, then, the architecture of SAFE should be reimplemented in a more distributed manner as part of a convergence on industry-standard software.

We have assumed that the eventual standardization of Project SAFE will be to purely commercial standards. This will never be entirely possible, if only because the intelligence community will continue to have certain unique communications protocols and encryption requirements. It also begins to appear that standards for data representations, packet switched networks, protocols, and command languages are beginning to evolve in major segments of the intelligence community: these may eventually become standards throughout it. If this happens, the intelligence community will have its own set of software and system standards which might form a more desirable focus for the standardization of Project SAFE than purely commercial standards will, while at the same time providing a large enough economic base for the support of SAFE's evolution to obtain industry-type economies.

For the foreseeable future, then, it will be necessary for the evolution of SAFE to be supported by resources internal to the intelligence community. CIA and DIA can take over responsibility for their specific interfaces, conversions, and implementations of SAFE within their respective communities, but there remain the enhancements or subsequent releases to the core SAFE software of Deliveries 2 and 3, which should be performed by a single group. It appears to us that this group should be associated with CIA for at least five years, not so much because of the uniqueness of SAFE application software as because of the CIA-specific nature of the system software base upon which it is built. Section 2 of the report discusses this in further detail.

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2. OVERALL RECOMMENDATIONS

2.1 Future SAFE

After core SAFE is delivered (Deliveries 2 and 3), future evolution of it should be in the form of new releases that add to rather than replace it (perhaps on an annual basis). Further, after Delivery 4 agency-specific additions and modifications to core SAFE should be the responsibility of the respective agency.

Because of the importance and complexity of Delivery 4, CSPO should retain responsibility for it. However, DIA has already taken responsibility for the DoDIIS interface and query language, and after Delivery 4 is installed and the conversion from DIAOLS has been made it should be reasonable to expect DIA to support its own needs (as long as the people it has assigned to CSPO return to DIA at that time).

After Delivery 2, CIA should take responsibility for the CIA-specific parts of Delivery 5 (interconnections to DIA systems, conversions, and integration with CIA indices and networks).

The other part of Delivery 5, which constitutes changes and additions to core SAFE, should be regarded as the first major additive release to core SAFE, but not as a replacement. Project management for the new release should be streamlined and simplified to reflect this view of evolutionary releases rather than new products: it should be possible to adopt a more "market-oriented" approach to the evolution of core SAFE, in which user feedback is the primary source of direction and contracts are in relatively small increments, forming a continual flow.

The result would appear as in Figure 1. Figure 1 shows calendar years 1983 through 1987, and the deliveries of Early Capability and Delivery 1. Deliveries 2 and 3 would form release 1 of core SAFE, with responsibilities for Delivery 4 and the CIA-specific part of Delivery 5 moving to those Agencies after Delivery 4 occurs. Then, future evolution of core SAFE would be in the form of additional releases. As noted in Section 1, these may eventually involve a complete rework of SAFE architecture with personal computers becoming the user state machine, and/or with the resource providing portions of SAFE becoming standard modules for networks used throughout the intelligence community.

2.2 Project Performance Compared to Original Goal

In Project SAFE Report to Congress of 23 September 1982, it was forecast that SAFE would be complete in fiscal year 1987 for an additional $192 million investment. The evolutionary plan presented in Figure 1 can be compared to this original goal.

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FUTURE SAFE

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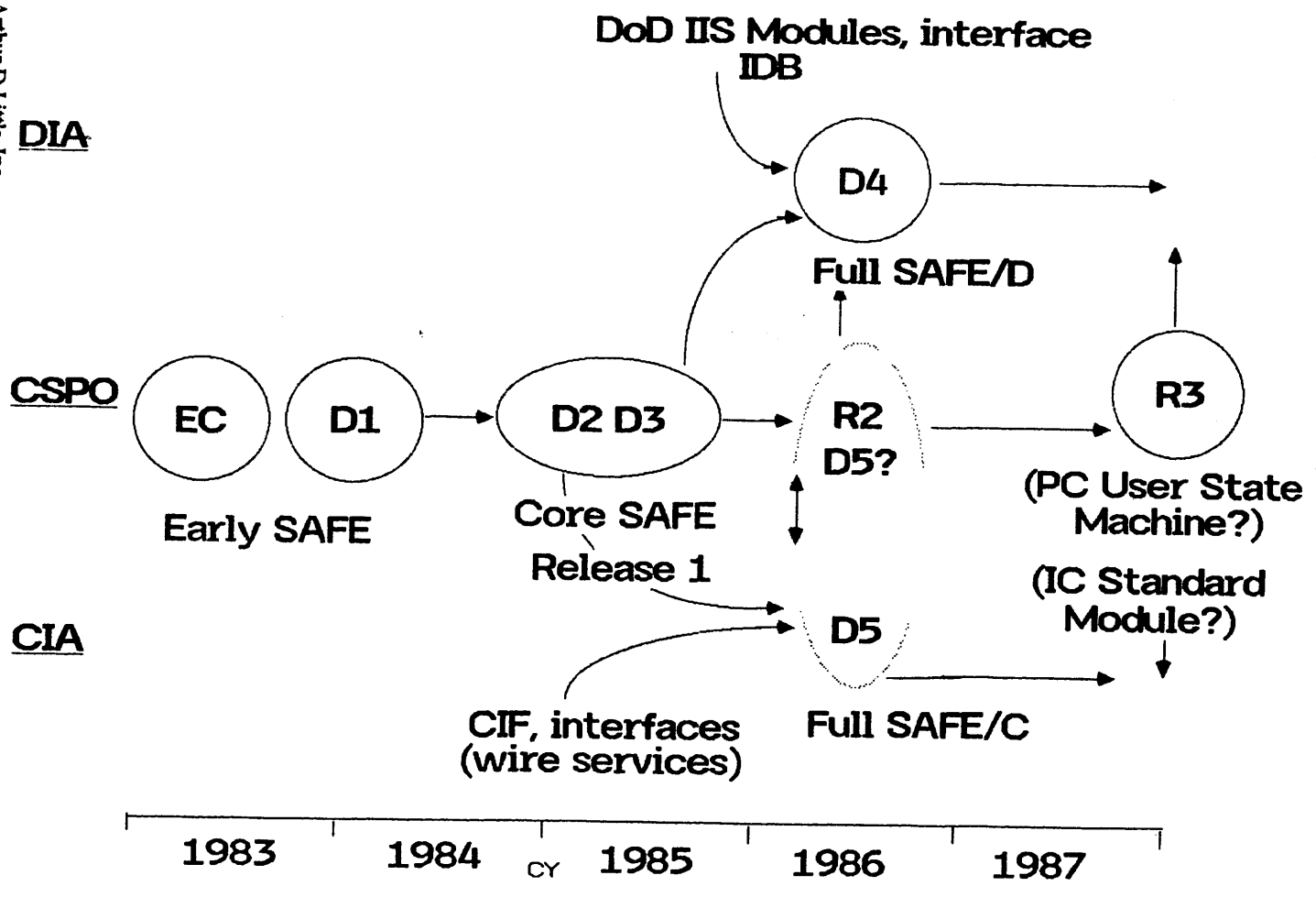

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The functions SAFE performs in 1987 will be somewhat different from those originally envisioned. SAFE will have fewer computing or manipulative features (number of windows simultaneously displayed, graphic options, algebraic processes, etc.). Instead, SAFE will have more interfaces to data sources, communication nets, and other intelligence community systems. Roughly speaking, an even trade will have been made between diversity of features and interoperability.

SAFE will continue evolving after 1987: it will not be "finished." There will be additional releases of core SAFE after that time, though it is difficult at this point to envision just what they will be. Also, DIA and CIA versions of full SAFE will continue to add unique capabilities, interoperability with other new systems and the like. Such continuing evolution will, however, require a far lower level of manpower and funding than the basic development of the system, which will have been completed with Delivery 4.

It seems to us that these variations from the original plan are desirable ones that do not reduce the original scope: it is fair to say that SAFE will be completed on schedule. (If the existing agreements on the functions of Deliveries 2-4 weaken, however, the schedule will be threatened.)

We also think that the $192 million investment should be enough to complete SAFE. As was recognized in 1982, the risk in the "industry-standard" approach is not so much in software or contract overrun as it is in requirements for computer power. Much of the software is commercial; that which is not is broken into small modules that are within the state-of-the-art, and individual overruns of time or money should not be enough to affect the total much. However, it is possible that with thousands of terminals exercising the full capabilities of core SAFE while interoperation with other systems is occurring, the computer power required to provide good responsiveness may be greater than forecast. As noted earlier, we suggest that CSPO undertake performance modeling to test this question.

Fortunately, we expect that before 1987 the manufacturers will offer substantial improvements in large IBM-compatible computers: we think it likely that any overrun in computer power requirement will be offset by improvements in the price-performance of processors available.

2.3 Organization Changes

We recommend that CSPO dissolve after Delivery 4 (by the end of 1986). When it does, the DIA employees should return there and continue to support the evolution of SAFE within the DoD community. CIA people should return there and exercise two responsibilities: some should work on CIA-specific interconnections and conversions; the others should retain the responsibility for the evolution of core

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SAFE. This group (relatively few individuals supported by contractors) should retain close contact with SAFE users and formulate reasonable release packages which they can propose as evolutionary additions to core SAFE. There should be a single overseeing board, representing all of the SAFE users, which responds to the proposals of the core SAFE group and provides funds for the approved releases.

To prepare for this dissolution of CSPO, we suggest that the DIA and CIA people be slowly reassigned as opportunities permit to activities related to their agency's releases. The QA group should become mostly DIA, because the relatively rigorous project management disciplines being practical by it are more applicable to DIA than to CIA. In the other three major groups, agency personnel should (to the degree convenient) be assigned by delivery: D2 and D5 manned by CIA people, D3 and D4 by DIA people. Finally, the CIA group working on Delivery 2 should prepare to become the continuing support group for core SAFE after the dissolution of CSPO.

After 1986, CIA would retain the obligation to support core SAFE for all users, but this obligation would be much smaller and more limited than the present obligation to support the full scope of Deliveries 4 and 5.

In approximately 1990, it should be possible for the responsibility to leave CIA. It might move to a commercial vendor, which we still hope will eventually provide systems that encompass all the functions of SAFE. Alternatively, it might move to the Intelligence Community Staff, if standards evolve across the community and if SAFE becomes a modular system capable of widespread use and interoperability within the Community.

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